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ABSTRACT

A study was conducted to evaluate the Inter-American Center for the Teaching of Statistics (CIENES), a center established in Santiago, Chile, by the Organization of American States (OAS) to improve statistical reporting and training. Study objectives were to evaluate the administration of CIENES, assess operating costs and program results, identify possible ways to better meet user needs, and identify possible duplication of effort and ways to operate more effectively. Documents were reviewed and interviews were conducted with OAS staff, CIENES students and graduates, and officials of concerned agencies and member states. Current needs in Latin America for CIENES and the role of the OAS are discussed. Information is presented on the three basic instructional programs in statistical techniques, applied social science statistics, and graduate-level mathematical statistics. Descriptive information is provided on the following topics: selection of candidates and recipients of technical assistance, physical plant and equipment, interview comments, operation costs and budgets, indicators of cost effectiveness, possible duplication of programs, multiplier effect of CIENES programs, publications, degree versus short courses, staffing, fellowships, and sub-centers. (SW)

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THE O.A.S. AS EDUCATOR - THE CASE OF THE INTERAMERICAN CENTER

For

TEACHING STATISTICS (CIENES)

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INTRODUCTION

Economic and social development is a primary goal of all of the countries of Latin America. Development, however, using that term in the broadest sense, is not easy to achieve. Resource scarcities are a pervasive fact in all human societies - more so in the less developed countries than in those more industrialized. As a result, developing countries must exert a great effort to extract the most product from available resources while keeping waste to a minimum.

Economic resources may be placed in four main categories; human or labor resources, land or natural resources, capital resources or the tools used for production, and knowledge which is sometimes called technology.

At first glance,statistics may seem to have little relation to the four main resource categories because resources are usually thought of in physical terms, such as tons or iron ore, acres of land, numbers of workers, and machines. Statistics, however, is a vital part of knowledge which manifests itself in several different ways; first, simply as the methods and techniques of gathering data; second, as the development of information systems; third, as the methods and techniques of analyzing data or information already gathered. Since statistics consists of series of data, as well as the methods of gathering and using data, it provides the means of gaining knowledge about a society, and using that knowledge for decision-making purposes.

Accurate statistical information is a necessary prerequisite for economic and social development. The decision makers of a country need information in order to make rational decisions. The decision makers may be private business firms, governmental agencies, or scholars. All, however, share the common need for reliable statistical data and the knowledge for using that data in a productive manner. Rational decision making leads to the avoidance of economic waste or the use of scarce resources in such a manner that economic welfare is maximized.

There seems to be little disagreement with the observation that historically businessmen and government leaders in Latin America have been constrained in the formulation of policy decisions because

basic socio-economic statistical series were either not available or were inaccurate, and an insufficient number of trained people were available to analyze the existing statistical data.

The extreme scarcity of information and people possessing analytical skills, in relation to land, human, and capital resources, contributes to a chronic condition of underdevelopment.

Is is against this background that the Organization of American States recognized the need to improved statistical reporting and training. OAS efforts in this direction have taken several different forms during the post-war period. Since 1962 a substantial effort has been made to improve the quality of statistical information generation and training through the establishment and operation of the Inter-American Center for the Teaching of Statistics, (CIENES) in Santiago, Chile.

Purpose of Study

The purpose of this evaluation study, as set out in the terms of reference was, in brief, to evaluate the administration of CIENES; assess operating costs and program results; identify possible ways to better meet user needs, identify possible duplication and ways in which CIENES might operate more effectively and efficiently.

Methodology

The methodology of the evaluation consisted of the following:

1. A review of the purposes of CIENES and the status of statistical training in Latin America through documents and interviews with OAS personnel.

2. A review of the degree to which the purposes were accomplished by analyzing documents and by interviews in Chile, Peru, Panama and Washington with—

   a. CIENES students,

   b. CIENES graduates,

   c. officials in agencies which made use of CIENES graduates and services,

   d. officials in universities and international organizations having an informed opinion of the nature and value of CIENES services, and

e. present and past professors of CIENES.

3. An analysis of budgets and other financial documents to ascertain, where possible, the costs of CIENES services and to compare these costs where possible to other available data.

4. An official request was made through OAS to all member states for information relative to the evaluative opinions each member state might have about the services of CIENES. The request was directed to the head of the statistical services of the government of each member state.

5. The mission met with OAS officials March 7, 8, and 9th and left for Santiago on March 14, 1978. Short visits to Lima and Panama City took place between March 26 and April 1.

UNIVERSITY ANTECEDENTS OF UNDERDEVELOPMENT

Universities in Latin America, one would think, would be training persons to meet national development needs, in this case the need for statisticians. Evidence is that they are, in general, not doing so. Even such a positive commentator as Galo Plaze (Plaza-Lasso, 1971, p. 134) has observed that Latin American universities are not oriented to the national needs but rather to the student elite establishment. The study of statistics historically has not been one that would generate great enthusiasm among elites or among upwardly striving students. Much better to study law, medicine or philosophy.

Further, our interview data indicates that students are presently accurate in their assessment. Job opportunities and professional status are not attractive relative to other professions.

Another factor is the traditional budget inadequacies which all too often characterize Latin American universities, and the possibility that the universities are too poorly organized and managed to spend wisely and efficiently the budget they get. Rational program decisions based on national developmental needs of a modern society are not the area of strength of traditional universities, and this affects the decision-making process with regard to program, curricula, and research support available to students and faculty. Students generally are still not receiving the education that will equip them to assume responsibilities in modern development technologies so sought after by governments in Latin America. Curricula are still in need of broadening to meet the demands of modern societies. There is still too little basic and applied research in universities (Gomez-Millas, 1965).

Another facet of the problem is the traditional shortage of highly specialized professionals, a fact which often prevents the university, even when it wants to do so, from offering training in technological fields or conducting research designed to speed up the developmental process. The teaching and study of statistics, from our evidence, is an apt illustration of this generalization. Graduates of the Master's Degree program at CIENES have largely entered university faculty ranks and carry much of the instructional load throughout Latin America, an index of the shortage (Cann, Mauch, Leavitt, 1978).

Another facet of the problem is the student and faculty activism which has seemed characteristic of the Latin American university. Strikes and closings of weeks and months are not uncommon in the life of an institution. The causes are complex - irrelevant curricula, demeaning and dehumanizing teaching methods, poorly prepared teachers and students, unwarranted governmental and political intervention, authoritarian violations of human rights, sharp conflicts over university autonomy - and differ from place to place, but the end result is usually that intense political conflict has been brought into the classroom and the university atmosphere has not been conducive to a high quality stable, sustained, reflective, analytical educative process for many students (Solvert, 1964).

These are some of the generalizations that are often made by observers. Although exceptions abound, these generalizations are clear to us as we visit our sister institutions in Latin America and talk with the faculty, students and administrators who make up the universities. These observations are relevant here because they help to explain the existence of a need in Latin America which organizations like OAS fill, whereas North Americans would expect universities to fill such needs.

THE ORGANIZATION OF AMERICAN STATES

The case of CIENES is better understood within the contex, not only of Latin American universities, but also of the organization of American States. The OAS is the oldest of the world's regional international organizations, and a principal vehicle for multinational regional cooperation in the Americas. The work of the OAS has changed over the years and in the past several decades it has concentrated its resources on technical cooperation and regional economic and social development programs. Regional programs were begun in educational development and scientific and technological development, and both programs support regional training centers like CIENES (Plaza-Lasso, 1971, p. 136-151).

The Centers in general have served several needs not always met and certainly not adequately met in earlier times. For one thing the

Centers (and CIENES would be an example here) can offer educational opportunities which can only be obtained at great universities, sometimes requiring travel abroad. At the Center, students can pursue studies in their own language and environment instead of traveling to Europe or the United States for a technical area, such as statistics. The student who goes overseas and successfully studies a profession or discipline in demand often stays, thus further contributing to the gap between developed and underdeveloped nations. The Center, by offering appropriate training locally, helps to retain the skills in the countries that need them most. Centers also benefit the host country by putting together a group of faculty, a critical mass of expertise, which represents a consultative resource and pool of knowledge and experience that is in constant demand - not only in the host country but also throughout Latin America.

CIENES exists, and is viewed by its clients as successful, because it fills a need no university is presently filling - short term, concentrated, high level instruction of an immediately practical and useful nature. It clearly meets national development needs, at least as defined by Latin American nations and by the OAS, because the nations and the OAS are its sources of students and funds. Our evidence was clear that the courses do equip students to assume technical responsibilities needed by developing countries. The political problems and strikes which plague Latin American universities are relatively absent at CIENES. Therefore, it was apparent to the investigators that CIENES, as an educative instrument of OAS, has been effective in reaching its goals.

There are other questions that are relevant, however. Should the OAS role continue as (clearly successful in at least this case) an educator? Is OAS devoting too many and too few resources to education, and are existing resources used optimally? Are the goals still appropriate and useful, or should they be changed and, if so, how? These are illustrative of issues we examined in this one case, the case of CIENES.

DESCRIPTION AND ANALYSIS

1. Background

CIEF (Centro Interamericana de Ensenanza de Estadistica Economica y Financiera) was an antecedent organization started in 1952 to train statisticians for the planning needs of American governments, particularly the ministeries of planning, development, education, finance and central banks and census offices. The courses taught were essentially of a nature similar to Program B (Socio-Economic Statistics) of the present CIENES.

CIENES started in 1962 with a similar but expanded mission. The work of CIEF had trainedin-service professionals who were enabled to use, understand and demand appropriate statistics in their professional work but had not put equal emphasis on the producers of statistics, those who could gather, manipulate and present quantitative data in an accurate, understandable and usable form for management decisions. CIENES embarked on a program to correct the imbalance and to train persons who in turn could conceivably help train others locally. Eventually an advanced course in Mathematical Statistics (Program C) was added.

Curricular development through the years and the increasing quality of students enabled CIENES to shorten the courses and increase the quality and intensity of instruction. Each program was divided into modules so that increased possibilities of student pacing and individualization of programs of studies became possible. The Basic Course on Statistical Techniques (Program A) for secondary school graduates was reduced from 10 to 4½ months.

Program B on Socio-economic Statistics designed for university graduates in, for example, economics, other social sciences and engineering,began as a ten-month program and was gradually modified to represent two modules of three months each, modulo basico and modulo de formacion, with the possibility of a more individualized two and one-half month period of application of statistical methods to a specific project of a practical nature.

Program C (Mathematical Statistics) designed as a "Masters" level course was started with a length of two periods of study of ten months each extending over two academic years. This program is designed to bring statistics professors at the university level up-to-date in their information and to prepare consultants in statistical methods for scientific and technological research institutions. Graduates are equipped to participate directly in the economic and social development process of their country. This program was subsequently reduced in time to eleven months duration. Although it has no legal authorization to do so, CIENES awards a Masters degree at the completion of the program, with a diploma signed, since 1973, by the Rector of the University of Chile and the Secretary-General of OAS. The objective of the program is basically the in-service training of mathematical statisticians. Although the degree has no legal status as has, for example, a university degree, it is recognized for its quality throughout the Americas and is commonly counted toward advanced degrees in universities, both in Chile and abroad.

2. Description of Basic Programs

The Inter-American Center for the Teaching of Statistics has offered three basic programs at its Santiago, Chile headquarters since it became operational in its present form in 1962. The three basic instructional programs are as follows:

1) Program in statistical techniques (Program A)
2) Program in applied social science statistics (Program B)
3) Post - graduate program in mathematical statistics (Progra

Each of the three programs contains different material. Progr A is the least intensive in scope and degree of difficulty and is designed to train persons in the production of statistical data in various types of public institutions. Program B is concerned primar with the analysis of socio - economic data. Program C trains specia in statistical theory and methodology at an advanced level.

PROGRAM IN STATISTICAL TECHNIQUES (Program A)

Part I Introduction - 1 1/2 months

Courses	Class hours
1. Economic and social statistics	24
2. Basic mathematics	70
3. Statistical methods	80
4. Statistical organizations	25
5. Data processing*	30

Part II Formative Core - 2 1/2 months

Courses	Class hours
1. Sampling methods	72
2. Survey techniques	78

Part III Specialized Topics - 1 1/2 months

Courses- Students work on practical applications in one area of specialization as follows:

1. Sampling methods applied to population census
2. Labor statistics

*Includes computer utilization

3. Educational statistics
4. Transportation statistics
5. Foreign trade statistics
6. Agricultural statistics
7. Social security statistics
8. Water, transport statistics
9. Demographics
10. Science and technology statistics
11. Employment statistics.

PROGRAM IN SOCIO - ECONOMIC STATISTICS (Program B)

This program is designed to provide intensive training in statistical methods and their application to socio - economic data and problems. Most of the students in this program are economists or other social scientists with a strong background in economics.

Emphasis is placed on the analysis of real data, the participation in seminars and research using data from the student's home country. Training in the use of the computer is included.

Part I Introduction - 3 months

Courses	Class hours
1. Mathematics	60
2. Probability	50
3. Statistical inference	50
4. Social and economic accounts	50
5. Economic analysis	50
6. Research seminar in economic analysis and national accounts	30

Part II Formative Core - 3 months

Courses	Class hours
1. Research methodology and planning	40
2. Economic model building	50
3. Topics in probability	50
4. Econometrics	60
5. Probabilistic models in economics and social sciences	50
6. Seminar in quantitative methods	40

Part III Special Topics - Optional - 3 months

Seminars, workshops and applied research offered to exceptional students.

PROGRAM IN MATHEMATICAL STATISTICS (Program C)

This is a post-graduate program for students who have an undergraduate degree in disciplines involving substantial amounts of quantitative preparation such as economics, engineering, and statistics. Successful candidates receive a masters degree in mathematical statistics.

Part I Introduction - 5 months

Courses	Class hours
1. Linear algebra	50
2. Advanced calculus	100
3. Introduction to probability	160

Part II Formative Core

Required Courses

1. Sampling	100
2. Statistical sequence	70
3. Linear models	70

Theory Option

1. Probability theory	110

Statistical Methods Option

1. Decision theory	30
2. Non-parametric method	80

Part III Special Topics - 4 months

A. Required Courses

1. Experimental design and analysis	60
2. Multivariant methods	60

B. Theory Option

1. Stochastic processes	60
2. Decision theory	60

C. Statistical Method Option

1. Topics in statistical methods	60
2. Time series	60

3. Selection of Candidates and Recipients of Technical Assistance

Candidates for CIENES Programs in Santiago are presented officially in rank order by their countries to the OAS. Each must be an employee of a national enterprise, e.g., one of the ministeries, the central bank, or a university. University faculty are usually candidates for Program "C" (Appendix L) The Secretariat for Development Cooperation Office, in Washington, processes the applications and appoints an ad-hoc committee to make final selections. Funded awards are limited to the number of scholarships available.

Candidates not awarded a scholarship may be admitted anyway if they can obtain permission from their place of work and secure support, either from the organization which employs them or from other scholarship sources like the United Nations, a foundation, or other governmental or OAS sources. Some candidates come on their own resources, but in any case the salary of the candidate continues and there is an expectation that the candidate has permission to take leave from the place of employment, has a promise of a place of employment upon returning, and has been officially presented by the candidate's government to the OAS. No candidates for Programs "A", "B", or "C" arrive from any other source. (Appendix E, F, G, H, M, N)

There are opportunities, however, for persons residing locally in Santiago to sign up for classes (asignaturas aisladas) but not for the complete program. Such persons may be admitted locally by CIENES, on a "space-available" basis to classes. They are expected to meet or exceed the same standards imposed on other candidates. In addition to training in Santiago, CIENES has offered training of various types in other cities of Americas Cursos Nacionales and Cursos Regionales. These are offered for persons of a specific country, such as Peru, or for a region, such as Central America. These programs are done cooperatively with the host, with some sharing of costs and administrative duties. Sometimes the programs consist of replication of one of the "A", or "B" programs in Santiago and at other times there is a specific application of statistical techniques to be addressed. In any case the application of the studies to actual case studies or investigations is characteristic of such cursos nacionales regionales.

Another major mission of CIENES is technical development assistance, new in a formal sense in 1977. This mission basically entails the sending of human and other resources to a country which has asked for technical assistance from OAS for a development project of national significance. The CIENES portion may be a part of a larger, multi-faceted program of technical assistance.

In both the technical assistance and the national programs, decisions are made in Washington regarding acceptance of proposals for help, and CIENES is brought into the negotiations surrounding those proposals in terms of ability to provide resources and the timing and nature of such resources.

In addition, there is international collaboration, which may take the form of teaching in a program set up by an international body, for example, an arm of the United Nations, and it may at times involve a considerable amount of technical assistance. (Appendix C)

4. Physical Plant and Equipment

a. Physical Plant

CIENES operates out of a four story reinforced concrete building of pleasing design and ample space which was designed for educational purposes. Offices, classrooms, and administrative areas are ample. The building is a contribution of Chile and is located on a section of the campus of the College of Economics of the University of Chile.

Chile also provides for building maintenance and utilities, both of which appear to be adequate.

The building also houses the CIENES statistical library.

b. Equipment

1. Equipment for office work, instruction and materials reproduction was found to be satisfactory in supply and condition.

2. Computing Equipment: An on-site IBM terminal was first available for use as a teaching tool in 1975. In 1976 the Center purchased a minicomputer, Interdata Model 7116. In 1976 it added an ONTEL OPI/64 terminal with a dual disk system, and in 1978 it purchased additional accessory equipment and software.
   This equipment, which is all compatible, is used for three major purposes: a) faculty research, including the production of statistical material for classes; b) instruction in each program, including exercises such a using census data; and c) small research projects selected by certain students in programs B and C as part of special seminars.

   The new equipment provides expanded facilities of adequate amount and capacity, but some of the most recent acquisitions had not yet been installed in March 1978.

   The computer center occupies a separate room in the CIENES building. It is of adequate size and is air conditioned in order to protect the equipment.

5. Views of CIENES

Interviews were conducted with CIENES graduates of Programs A, B, C in Santiago, Chile. The graduates appeared to be frank in their assessments. As a group, they were impressive, articulate, and appeared to be making a significant contribution to the development of their respective countries.

The general assessment of the graduates of Program A, B, and C of CIENES was very high. There was a large measure of agreement concerning the following generalizations about CIENES:

1. The level of instruction is appropriate to the objectives of the program and to the needs of the students.

2. The instruction is intensive, more so than it would be in other institutions of higher education according to students who had the experience to make such comparisons.

3. Graduates of CIENES are respected throughout Latin America, and are valued for their practical orientation and ability to perform on the job.

4. CIENES training has been very useful to the employing organizations and the graduates who often obtained increased responsibility or changes in assignment as a result of the training.

5. CIENES training is known, respected, and valued throughout Latin America.

6. The short term courses are better prepared and taught than university courses in the same area, reported students. The student and teacher interaction is close, professors always helpful.

Some typical comments which were reported by graduates in various forms:

1. The Program A gave me much greater understanding of statistics and how to use them. It helped me to ask appropriate questions to identify manipulable and non-manipulable variables in educational research.

2. The program was much more practical than a university program, which is too theoretical for our work. In our office, a university graduate may have the theory of statistics, but when he is confronted by a practical problem, he doesn't know how to solve it. CIENES graduates do solve those same problems every day.

3. University credit should be given to students in Programs A and B - the courses are certainly of university level. A student in Program A, for example, would get more statistics than a student in a four year university program for Tecnica Estadistica or Ingeniero Commercial. Program B would be beyond the statistical training offered at the university at the first degree level.

4. Add to the curriculum modules on fiscal planning, development planning, and educational planning.

5. CIENES gave me the skills to use data which had been lying around the ministry for years - data collected and useful, but not used because no one had the skill before. Not only am I using my skills, but I am also teaching in-service classes to colleagues in the Ministry.

6. When I took the university entrance exams, I took the top grade in the statistics section, due I believe to the intensive CIENES course I completed. In my university, the most statistics is taught to Mathematical Engineers, and that is a 6 - 6½ year course. They get less than we get in Program C.

7. Another student from Program "C" reported that her work at CIENES was accepted toward a graduate degree at a major U. S. university.

8. The courses are too intensive and leave little room to falter or get behind because of sickness or other emergency.

Alumni in Peru were also laudatory in their remarks about the training, but they too felt the courses were too intensive and left little time for reflection or analysis of what they were learning. They also felt that their courses were a bit too theoretical. But, on the other hand, they were impressed with the practical nature of the national course given at the National Institute of Statistics by CIENES. They wanted to see the same help given to the Ministry of Education statisticians.

With regard to duplication, alumni agreed that their CIENES work would count toward a university degree, but that it was presently unavailable in the universities in that format at least.

Peruvian alumni, as indeed those in Panama, saw a great need for a continuous relationship with CIENES, perhaps as an association of alumni meeting regularly and exchanging ideas, work, and information, supporting one another professionally. Perhaps it could take the form of a professional society, as in Mexico and the United States. Perhaps also they could do some extension work by mail and be brought up to date periodically with the latest ideas in the use of statistics for national development and planning. There was a feeling of isolation and being cut off, once the course at CIENES was over.

Suggestions were made for follow-up courses, alumni newsletters, a directory of former students, and a journal of statistics. They suggest that a Peruvian organization, such as INE, or one of the universities could help organize activities under CIENES leadership, for a majority of the professionals in statistics were CIENES graduates.

In some cases, probably due to administrative and bureaucratic problems beyond the control of CIENES, the notification of acceptance to a course came very late, and there was little time to prepare for the course, and little information concerning the specific preparation which would be appropriate.

CIENES graduates in Panama were generally well satisfied with their training and expressed their respect for the professors and the intensive nature of the courses. In addition to the general highly complimentary comments, some graduates made specific suggestions for change or made specific comments regarding some aspect of their training.

For example, there was a suggestion to increase the attention devoted to the economics of national development and models of national planning. There was agreement that Panama offered no statistics sequence in the depth or level of CIENES, and former students seemed to be asking for more practical application to planning and national development. They also expressed the need for help to do regional (i.e., provincial) economic and social planning and development.

Several graduates also felt the courses at CIENES were too theoretical and that not enough practical examples were used, with special emphasis on differing needs among the various regions of Panama. Practical applications of applied statistical methods were requested, but graduates were quick to add that the CIENES courses were better, more practical and useful, and taught at a higher level than their own university courses. The best students were sent to CIENES and they had good professional opportunities upon completion of their courses. They saw little duplication with available statistics courses taught at the University of Panama, but they did note that CIENES work was given credit at the University. As in Peru, graduates expressed a desire for a continuing relationship with CIENES after graduation.

6 .. Operation Costs and Budgets

a. Introduction

Apparently, neither CIENES in Santiago, nor OAS headquarters keep accurate nor consistent cost records for CIENES operations, at lea the evaluators were unable to secure real cost information.

What was available to the evaluators was budget data from several sources, but this is not cost information unless one assumes that every dollar budgeted for an item is actually spent on that item. Moreover, there seemed to be some difficulty in obtaining precise OAS budget data for all of the years covered by the study from the Washington Headquarters. The OAS in Washington, furthermore did not provide the evaluators with data on actual costs,

Chilean contributions to CIENES or contributions from other sources. As a result, it is impossible to make a precise estimate of CIENES operation costs.

If one arbitrarily assumes that the costs of operations were identical to amounts budgeted for operations, then the following general picture emerges. CIENES operations have been financed from several sources. The major source of financial support has been its parent organization - The Organization of American States. It has also received regular, but lesser amounts of support, often in kind, from Chilean institutions, and it has also received occasional grants and fellowships from other international organizations. Amounts received from the last source are unknown, but appear to have been small and randomly spread over time.

b. Budget Support

Total OAS-Chile budget support for CIENES varied from a low of $314.5 thousands in 1962 to a high of $874.9 thousands in 1977. On the average, combined budget support rose by 7.7% per year. (Appendix U)

OAS budget support varied from a low of $221.7 thousands in 1962 to a high of $788.9 thousands in 1977. On the average, OAS budgets rose by 7.9% per year. Looked at from another point of view, the average dollar trend increase in OAS support amounted to $24.7 thousands per year from 1962 to 1978. (Appendix T)

Chilean budget support in dollars varied over time by considerable amounts because of internally high rates of inflation during the years 1972 through 1976. Nevertheless, after escudo and peso contributions were converted to dollar amounts at average annual exchange rates, total Chilean contributions were as low as $56.6 thousands in 1973 and as high as $95.4 thousands in 1971. On the average, Chilean contributions to the CIENES operation amounted to $83.3 thousands per year, but varied from this mean by as much as $11.2 thousands per year. (Appendix Q)

c. Analysis of OAS Budget Contributions

The 1961-1978 CIENES budgets consist of four principal items: salaries, fellowships, personnel travel and equipment-supplies. During the period under consideration, salaries averaged 52% of of the total budget, fellowships averaged 41.6%, personnel travel averaged 2.4%, and equipment-supplies averaged 4.0%. There has been little tendency for the relative amounts to change between 1962 and 1978. The salary relative share of the OAS budget only tended to rise at an average of 1.3% per year, while all others tended to fall. The fellowship relative share fell

by -0.56% per year, travel fell by -0.46% per year, and equipment-supplies fell by -0.3% per year. (Appendix V)

d. Salaries

OAS budgeted salaries consisted of clerical, professional, and contract salaries. The last item comprises payments to part-time professors hired by CIENES to assist in the teaching of national courses in countries other than Chile. Total salaries were as low as $93.4 thousands in 1961-62 at the beginning of the program and as high as $443.1 thousands for 1978. Mean total salaries for the sixteen year period amounted to $256.9 thousands with a standard deviation of $101.2 thousands. On the average, total salaries tended to rise approximately $19.2 thousands per year.

Clerical salaries averaged $19.8 thousands but tended to be lower during the last two years. During early years some portion of clerical salaries of the OAS Washington staff were charged to the CIENES budget. Clerical salaries tended to rise by $100. per year.

Professional salaries, those for the full-time teaching staff at CIENES, gradually rose over time from approximately $100.0 thousands per year to $407.0 thousands in 1977. The mean for faculty salaries is $228.5 thousands, and on the average they tended to rise by $19.0 thousands per year.

Salaries for contracted teaching staff for national courses of short duration first appear in the budget in 1969-70 at $30.0 thousands. The annual budgets for contract salaries varied considerably from year-to-year but had a mean of $18.2 thousands. Since 1969-70, contract salaries tended to rise by $1.3 thousands per year. The rise in total salaries since the 1969-70 budget is partly accounted for by the increased use of contract faculty instead of additional permanent professional staff. (Appendix W)

e. Travel

The CIENES travel budget has varied widely over the years from a high of $53.9 thousands in 1962-63 to a low of $754.00 in 1967-68. Travel allocations have increased in recent years in order to permit professional staff travel to teach national courses in other countries. On the average, travel has amounted to $8.7 thousands per year. It has a large standard deviation of $14.5 thousands which reflects large year-to-year changes. The general trend, however, shows an annual decline of $900. (Appendix W)

f. Equipment and Supplies

Equipment and supplies budgets also varied greatly from year-to-year from a low of $6.9 thousands to a high of $33.6 thousands. On the average, equipment and supplies budget amounted to $17.7 thousands per year. The general trend for this budget item was $200 per year. (Appendix W)

g. Fellowships

Fellowships account for the second largest budget item. In total, they have ranged from $65.3 thousands per year to $312.9 thousands per year. On the average, fellowships have been budgeted at a level of almost $200.0 thousands per year. There has been a tendency for fellowships to rise at approximately $6.2 thousands per year. For 1978, however, the fellowship budget has been reduced to $147.3 thousands. (Appendix W)

Fellowships have been included in the budgets of several OAS departments, and a few have been awarded by other institutions. It seemed difficult, however, for OAS to gather fellowship data so that the total could be made known to the evaluators.

7. Indicators of Cost Effectiveness

Four different analyses of cost effectiveness were made from the data available: an allocation of CIENES salaries by function, a comparison of CIENES salaries with those paid for professors by other organizations teaching statistics, an estimate of cost per student for all instructional programs, and a regression analysis relating total OAS budgets to total enrollments. Supporting tables appear in the appendix.

a. Salary Allocation by Function

The purpose of this analysis is to determine whether inordinate amounts of faculty time were devoted to non-instructional activities. By implication, one can roughly determine whether or not dollars spent for salaries were used for teaching and technical assistance or for other purposes. The test included one director, one assistant director, one administrative officer, one administrative expert, and eleven professors. Time allocations are expressed in terms of man-months devoted to five basic functions using 1977 as the sample year and 1978 salaries as the sample salaries.

The results show that 51% of total man-months for all CIENES personnel was devoted to the teaching of on-site courses, 10% to technical assistance, including national courses, 11% to cooperative programs with other institutions, 20% to organization and supervision, and 8% to vacations, sick leave, and other absences. (Appendix P)

If personnel with administrative duties are excluded, the eleven professors devoted an average of 62% of total man-months to on-site teaching, 11% to technical assistance, 14% to cooperative programs, and 4% to organization and supervision. (Appendix P)

Although the director has generally taught courses part-time in the past, he devoted full-time to administration in 1977. The assistant director devoted 58.4% of his time to teaching, technical assistance and cooperative programs, and 35.8% to organization and supervision. The administrative officer was involved in on-site teaching for approximately 45.8% of total time. The administrative expert devoted 91.7% of total time to organization and supervision. (Appendix P)

If salaries are allocated in accordance with man-months by activity, then one may conclude that $338.0 thousands or 74% of the total salary budget was spent for teaching, technical assistance, and cooperative programs. $79.9 thousands went for organization and supervision or 18%, and $38.1 thousands or 8% was absorbed by vacation time, sick leave, and other absences. (Appendix Y)

On the basis of this analysis the evaluators feel that the bulk of salaries paid by OAS are being spent for intended purposes as defined by the CIENES mission and goals.

b. Comparative Salaries Analysis

An attempt was made to compare CIENES salaries with those paid at the University of Chile, United States' universities, and the Asian Statistical Institute. The results are shown in Appendix X.

Various adjustments were made to try to make the salaries at all institutions as comparative as possible. For example, the U. S. salaries were all increased by 20% for summer teaching in order to get a full-year salary, and salaries paid at the Asian Statistical Institute were adjusted upward by the post cost of living index for Santiago, Chile. Despite these and other minor adjustments it was impossible to take into consideration all of the factors that might affect a person's gross salary, or more importantly take-home pay. No attempt was made, for example, to adjust U. S. salaries for taxes paid since tax liabilities depend on so many different factors.

In general, the comparative salary analysis indicates that CIENES professional salaries are not grossly different from salaries paid at the Asian Statistical Institute or from salaries paid for U. S. professors working a full, 12 month year. It is obvious, however, that CIENES salaries are approximately double amounts paid to professors in the school of Economics at the University of Chile. However this disparity must be seen in light of the fact that CIENES professors are expatriots and therefore entitled to compensatory benefits, work full time, and are subject to two and three month assignments in other countries. (Appendix X)

c. Cost Per Student Analysis

Total OAS budget amounts per year were divided by total enrollments for all years from 1962 through 1977. The enrollments include students with fellowships taking on-site courses in Santiago as well as students enrolled in national courses in other countries. The analysis reveals that cost per student varied with budgets and total enrollments from a low of $1.1 thousands in 1962 to a high of $4.0 thousands in 1970. On the average, however, cost per student amounted to $2.16 thousands with a standard deviation of $0.81 thousands. A trend analysis of the same data yields an intercept of $2.15 thousands for the beginning year of 1962 and a slope value of zero. In other words, cost per student did not increase over the 16 year period, but stayed constant at approximately $2,150.

Even though the OAS budget tended to rise at approximately $25.9 thousands per year, cost per student remained constant because total enrollments tended to rise by 15 students per year. It should be noted that the student enrollment in Santiago tended to fall by 2 per year, but this was offset by increased enrollments in national courses at approximately 21 students per year. (Appendix R)

d. Linear Regression Analysis

A least-squares, linear regression test was made of the relation between total OAS budget appropriations and total enrollments per year over the 16 year period from 1962 to 1977. This kind of statistical test makes the assumption that student enrollments depend entirely on budget appropriations. That assumption may be unrealistic for other private or public educational institutions where students pay fees for educational services, and where the institutions receive financial support from multiple sources. It does not seem to be an unrealistic assumption for CIENES, however, because the bulk of its budget comes from OAS and because most of that budget is made up of faculty salaries and fellowships.

The regression analysis yields the following statistics:

Intercept value : 0.0407

Slope of regression line : 0.000597

Coefficient of Correlation: .775

In terms of a formula the regression takes the following form:

$$y = a + b\,x$$

where y = enrollments
x = budget appropriation
a = value of y when x is zero
b = change in enrollments for every unit change in budget

Placing the calculated values in the formula produces:

$$y = 0.0407 + 0.000597\ x$$

One may now set up the following table showing the relationship between budget (x) and enrollments (y).

Budget Dollars	Expected Enrollments	Change in Enrollments
$ 1,000	0.6	-
2,000	1.2	0.6
3,000	1.8	0.6
4,000	2.4	0.6
10,000	6.0	3.6
100,000	60.0	54.0
200,000	119.0	59.0
300,000	179.0	60.0
400,000	239.0	60.0
500,000	298.0	59.0
1,000,000	597.0	299.0
1,500,000	895.0	298.0
2,000,000	1,194.0	299.0

The table may be interpreted as follows: For every $1,000 increase in OAS budget appropriations, the number of students enrolled in CIENES programs will increase by one-half student per year, i.e., 0.6 students. For every $100,000 increase in OAS budget, student enrollments will increase by 60 per year. For every $500,000 increase in OAS budget, student enrollments will increase by 298 per year. For every $1,000,000 increase in OAS budget, enrollments will increase by 597 students per year.

What kind of conclusion can one draw from this analysis? A technical conclusion is that we can have some confidence in the results because the coefficient of correlation has a reasonably high valve of .775. This only means that mathematically the budget explains most of the enrollments.

What, however, do the results mean with respect to the CIENES operations? It is very difficult to make a certain and categorical reply to that question because we do not have comparative data from other similar kinds of educational institutions. Is OAS willing to spend an additional $1,000 per year to get one-half more student into a CIENES program? Is it willing to spend an additional $100,000 per year to gain 60 more students? Is it willing to spend an additional $500,000 per year to gain 298 students?

The equation also works in reverse. If OAS cuts its CIENES budget by $100,000 per year, enrollments will fall by 60 students per year. If it cuts the budget by $200,000 per year, enrollments will fall by 120.

In 1977 the OAS budget for CIENES was almost $800,000. If that were cut in half, back to $400,000 predicted enrollments would fall by approximately 240. If that occurred without any restructuring of CIENES programs, it is the opinion of the evaluators that the CIENES operation would be a costly operation in terms of dollars spent per course or per student.

This analysis of the relation between budget and enrollments leads to the general conclusion that the OAS and CIENES should carefully consider the adoption of alternative missions and goals, alternative programs, and alternative forms of organization.

There are, after all, universities in Latin America that can teach statistics. Some are good. Some are very bad. Some, given proper incentives and support, might develop first rate programs. The OAS, which is an inter-American organization and not an educational institution, must decide whether it wants to operate an educational program, in this form. Sooner or later each country must develop an independent statistical capacity, and the sooner the better. That capability would consist of governmental institutions possessing the skills necessary to gather and analyze data as well as educational institutions capable of teaching statistical techniques. The evaluators believe that there are some alternative means of generating that capability given the fact that the countries of Latin America are undergoing rather rapid economic and social change. This may be an opportune time to affect some changes in and redirection of CIENES programs.

8. Possible Duplication of CIENES Programs

The evaluators asked all persons interviewed if they knew of any duplication of CIENES courses or programs in Chile or other countries. The persons interviewed included former students, university professors, and personnel in user institutions in Chile, Peru and Panama.

Everyone stated that he was not aware of any program duplication, but that one could find several courses in statistics, mostly at the introductory level, being taught in the economics, mathematics, and engineering curricula at several universities.

An exact duplication of CIENES programs in Chile or elsewhere would not be likely because of the unusual mixture of teaching, technical assistance, and cooperative programs. Some universities teach

courses in statistics but not as a part of a well-intergrated statistical program. Some international organizations provide technical assistance, but do not offer educational programs.

There may be educational programs of equal coverage and sophistication in two or three countries such as Brazil, Mexico and Venezuela. Brazil provides an example of what could be a growing trend in statistical education at the university level among the wealthier countries. At the undergraduate level, for example, diplomas were awarded in statistics to 84 graduates in 1973 and 36 in 1974. The Ministry of Education reported that it recorded 141 new statisticians with degrees in the professional register in 1973 and 34 in 1974. At the Masters level the University of Sao Paulo offers one program in Applied Statistics. In 1974 the program employed three professors; matriculated 99 students. It graduated five students in 1973. The University of Sao Paula also has a relatively new program in Biostatistics with six professors; nine matriculated in 1974, and three graduated in 1973. In addition this university offers masters level program in related areas, including Computer Science, Systems Analysis, Economics, and Mathematics. At the doctoral level Brazil offers two programs in Computer Science and Two Programs in Mathematics.

At the present time Chilean universities provide basic instruction in statistics in several programs including medicine, engineering, social sciences, and agricultural sciences. In Santiago, only the Catholic University offers a professional degree in statistics at the undergraduate level. The University of Chile offered a degree in statistics several years ago, but the program has been suspended.

9. Multiplier Effect of CIENES Programs

The so-called educational multiplier effect may be defined as a process by which the educational system trains persons to be teachers who then pass on knowledge and skills to many other persons.

The more teachers a country has, the greater is its capacity to educate the population, however, there would seem to be some economic limit to the process since investments in education must compete with investments in all other forms of infrastructure and capital in terms of a social rate of return.

Basically, this is a question of human capital formation and it is legitimate to ask whether or not CIENES programs have had a multiplier effect in the area of statistical knowledge and skills. Two tests were performed to answer that question. First, before and after occupations of CIENES graduates from Peru and Panama were examined as a sample. Second, current occupations of all CIENES graduates from Programs A, B, and C were examined for the period 1962 - 1976.

With respect to Peru and Panama, it was found that Program C (Mathematical Statistics) generated the greatest multiplier effect through the production of teachers. In Peru, an estimated 74% of Program C graduates became or remained teachers of statistics in universities. One would normally expect the lower level A and B Programs to show fewer persons going into education, but an estimated 23% of Program B (Socio-Economic Statistics) graduates in Peru became professors of statistics. (Appendix J, L)

The Panama sample had fewer students overall. However, the proportion of CIENES students employed in teaching was similar to that in Peru.

The overall results of the second test are shown in Appendix J. It reveals the following current occupation proportions by program. For Program A, 95% of CIENES graduates are employed in government agencies, 2.4% by universities, 2.6% by private organizations, and 2.1% by international organizations. For Program B, 73.7% are employed by government, 20.9% by universities, 5.4% by private business, and 2.5% by international organizations. For Program C, 18.9% are employed by government, 73.6% by universities, 7.5% by private organizations, and 0.5% by international organizations.

The fact that almost three-quarters of all graduates from the masters level program in mathematical statistics are currently engaged in university teaching is prima facie evidence of a potentially high multiplier effect for that program. The addition of almost one quarter of graduates from the program in socio-economic statistics lends further weight to this conclusion.

The possibility that graduates quickly found high pay employment with private business was an initial concern of the evaluators. That, however, has not been the case. Only a small portion of all graduates were employed by private business firms.

The total impact of statistical education on the transfer of knowledge in this area, however, cannot be measured only in terms of those graduates who remained teaching or became teachers. It can be argued that many of the graduates currently employed by governmental agencies may have a substantial knowledge transfer

effect on other employees with whom they have daily contact on the job. Ninety-five per cent of Program A graduates returned to government employment, 73.7% returned from Program B, and 18.9% returned from Program C. (Appendix J)

10. Publications

There was agreement that not enough is published in Spanish and that a reading knowledge of English is almost a requirement for advance statistical studies. This fact excludes the vast majority of potential users of useful articles in Latin America. A journal should be published by CIENES and it would fill an important need. It could publish the best of students' papers and professor articles, concentrating on empirical work of an immediately useful nature. Knowledge transmission would be an important objective. Also the journal could publish some of the CIENES teaching materials, especially sections from elementary texts used by CIENES.

Case studies, for example, in estimating error in national census activities, in methodology for industrial censuses, could be very helpful, and would help the American nations share experiences, skills, and data. One might also conceive of an interfacing effect so that nations could collect statistics in a coordinated way.

On the other hand, the cost and difficulty of producing a first-rate scholarly journal would be considerable, and certainly the resources for doing so do not presently exist at CIENES. One possible way to deal with the problem might be to transfer the REVISTA ESTADISTICA now published by OAS in Washington to CIENES for a trial period with some agreed-upon guidelines for its direction and quality. Appropriate resources to support this function would need also to be transferred to CIENES.

11. Degree vs Short Courses

CIENES does now offer a degree (M.A.) for completion of its Curso "C", as described elsewhere in the report. A legal university degree in most of the American nations has to be awarded by an institution authorized by the state to award degrees, and therefore CIENES could not offer degrees by itself in a legal sense. It could, however, do so in conjunction with national universities, if that were negotiated. In such a case, CIENES would probably teach the statistics and the university would teach all else it requires for a degree. Such an arrangement would be feasible, and indeed there is evidence that it exists already since CIENES course credits are now transferable to universities. However, few universities offer as much statistics, at as high a level, as does CIENES, and a more formal arrangement might increase the level capability of those universities that chose to enter into agreements.

In dealing with this question, one must recognize that universities traditionally educate persons through a degree program of several years duration, and that short term specific in-service courses are fairly new and infrequent as degree courses. Degrees are awarded for longer periods of study for a more varied program of studies than would be the case with CIENES offerings. The CIENES programs, as offered, meet the need to train personnel in statistical methods in as short a time as possible, as efficiently as possible. After all, the students are important government employees, for the most part, and they are a very scarce resource. The training is expensive, and it is not meant to be a general education course leading to a first university degree or a professional degree.

We would conclude that during the five year reorientation of CIENES mission towards international technical assistance, those responsible for taking over the CIENES teaching function might consider the possibility of negotiating joint ventures with universities to train statisticians at a higher level than is now possible at the university, with a broader education than CIENES can give, resulting in a degree after appropriate work has been performed by the student. These arrangements could be worked out in any Latin American country, and they need not be limited to arrangements with autonomous national universities. Many of the newer institutions such as Colegios Universitarios-Institutos Universitarios de Tecnologia, or Polytechnic Universities might be more appropriate in some cases; indeed private and church universities would be another possible source of cooperation.

12. Mix of Staff

Teaching, service and research institutions like CIENES and similar institutions of higher education depend heavily on full-time staff. The contracted personnel, even though they may be outstanding, do not have the same commitment to the institution; their professional lives and self respect are not dependent on the excellence of the institution. They draw their legitimate professional rewards elsewhere. Like consultants, they come to do their brief part, then they go on, their very detachment lending credence to what they do. It is the full time staff that can be expected to live out their commitment by expending their time and energy in extraordinary ways. Without full time staff one cannot expect devotion to the necessary but time-consuming backup work in curricular development, student advisement and help, course planning and evaluation, and in providing continuity and consistency of direction to the program. They are fully committed to the excellence of the institution because it is their professional lives. All our experience as professors in universities lead us to this conclusion, as well as the evaluative comments of faculty, students and users of CIENES services.

The permanent staff of CIENES is inter-American in make up. Full-time professors in March 1978 were as follows:

Name	Nationality
Carlos Araujo	Uruguyan
Enrique Cabana	Uruguyan
Arnoldo de Hoyos	Mexican
Emilio Ellena	Argentine
Evalio O. Fabbroni	Argentine
Pedro Ferreira	Uruguyan
Reynaldo Franco	Peruvian
Mario Kaminsky	Argentine
Pablo Mandler	Argentine
Oscar Miranda	Chilean
Sergio Pinto	Chilean
Jose Luis Varela	Uruguyan

From time-to-time CIENES also contracts for individual professors to teach special material for short periods. In 1977 CIENES contracted with the following persons to teach on-site courses in Santiago:

Rene Barros	National Computation and Information Enterprise
Fabio Cardenas	Interamerican Center for Tourist Training
Berta Castillo	University of Chile
Fernando Flores	National Statistical Institute of Chile
Eduardo Miranda	UNESCO
Ernesto Schiefelbein	Center for Educational Research and Development

In recent years CIENES has offered a growing number of so-called national programs. These generally consist of basic statistics courses offered in other countries. In most cases local instructors are hired for short periods to assist CIENES staff members in the teaching of specific courses.

13. Fellowships

Fellowships were awarded for Programs A, B, and C, during all years from 1962 to 1977. Since 1973 other fellowships were given for purposes othe Programs A, B and C. An average of 67 fellowships were awarded each ye and there was a slight upward trend of almost 2 fellowships per year unt 1977. (Appendix M).

In terms of percentages Program A fellowship averaged 36% of total fell Program B averaged 37%, and Program C averaged 27% of the total. (Appendix M).

Since 1973 an average of 38 fellowships were given per year for purposes other than Programs A, B, and C. During the last five years the number of fellowships awarded for the three basic programs conducted in Santiago have tended to decline as the number of fellowships for off-site programs was increased in line with a growing concern for providing technical assistance through localized, national courses. (Appendix M).

Between 1962 and 1977 a total of 1,063 students with fellowships participated in CIENES programs. Total enrollments in all programs during the same period amounted to 3,863 students; therefore, students with fellowships amounted to approximately 31% of total enrollments. (Appendix N)

It should be noted that total student enrollments exceeded the number of students with fellowships largely because of national courses given in the country and city in which students resided. (Appendix N)

At the present time, a fellowship provides round-trip transportation plus a living allowance of $312 per month. Originally, the monthly living allowance amounted to approximately $280. Some of the former students thought that living allowances were adequate while others did not. The kind of response given seemed to depend largely on whether a fellowship student had dependents to care for and on whether the student was on leave with pay from regular employment.

If the cost of living and transportation continues to rise in the future as it has in the past, it will become increasingly difficult for students to accept fellowships if the monthly living allowance remains constant. If OAS increases the monthly living allowance without also increasing the fellowship budget, it will mean that fewer fellowships can be offered. As a consequence, CIENES will have fewer students, and its level of efficiency will fall. If OAS wishes to maintain a constant number of fellowships per year, one cannot escape the conclusion that the amount of money allocated to the fellowship budget will have to increase. Since it is recognized that the OAS does not have unlimited funds to allocate to the fellowship budget, the evaluators have made a recommendation for sharing fellowships with member countries. Since it is recognized that the OAS does not have unlimited funds to allocate to the fellowship budget, the evaluators have made a recommendation for sharing fellowships with member countries.

Some former students said that fellowship awards were given too late to enable them to arrive in Santiago before courses began. Some in fact arrived after courses had already begun. Students expressed the opinion that fellowships should be awarded early enough to give them time to settle affairs at home and to give them a few days to find lodging and get settled in Santiago.

14. Sub-Centers

The establishment and operation of permanent sub-centers of CIENES has been suggested as one means of spreading statistical education over a wider geographical area and of reducing the costs of travel to Santiago.

Although CIENES has offered a large number of national programs in member countries, these should not be confused with a true sub-center. A sub-center, in the opinion of the evaluators, implies a permanent operation with a permanent staff, and on-going programs. CIENES national programs have all been temporary, of short duration, served by one or two professors from Santiago, and have involved local professors working under short-term contract.

Panama and Brazil have been suggested as possible locations for permanent sub-centers to serve their regions, while Santiago would continue to serve the Andean region.

The evaluators are of the opinion that the establishment of two or three permanent sub-centers would divert attention and resources away from the new recommended technical assistance orientation of CIENES. In addition it would in all liklihood increase CIENES operations costs by substantial amounts. It would imply additional professional and clerical staff, additional costs for travel, equipment, supplies, and library facilities, and computer equipment. The only savings would probably be in transportation and living costs for students, therefore, money allocations for the fellowships might be lowered. On the other hand, each sub-center would probably have fewer students per year than Santiago, therefore, the average cost of education for students would rise, and CIENES efficiency would fall.

The distances between sub-centers, and delays in communications would create administrative, organizational, and supervisory problems that do not exist at the present time.

In line with the major recommendation to reorient the mission of CIENES, the development of national and regional centers should be emphasized through assistance provided by CIENES to local institutions.

MANDATES, GUIDELINES AND OBJECTIVES

The key mandates, guidelines and objectives of CIENES may be found in the following documents.

1. Resolution XIX, of the special meeting of the OAS, July 8, 1959 calls for the training of personnel in statistics to meet the needs of American states.

2. "The Education and Training of Statistical Personnel" (IAST Doc.4291a - 7/13/61 - 100) provides guidelines and projections for a training center in statistics, the outgrowth of which was CIENES.

3. The "Report of the Fifth Inter-American Statistical Conference, 1967" recommends specific actions to CIENES and recommends its continuation.

4. The "Report of the Sixth Inter-American Statistical Conference. 1972" recommends specific actions and continuation of CIENES.

5. The "Summary of Conclusions of the VII Inter-American Statistical Conference" recommends specific actions to be taken and recommends the strengthening of CIENES.

6. An "In-depth Evaluation of the Program of Statistical Affairs", includes the evaluation of CIENES made in 1972 and an introduction to the Center.

7. The agreement between the Government of Chile and the OAS (then Pan American Union) establishes the still on-going relationship between the two organizations.

8. The "Report of the Advisory Committee on Administrative and Budgetary Matters Regarding the Preliminary Program, Program-Budget of the Organization 1978-79 (AG/CP/ doc. 173/77, 28 September 1977" recommends the undertaking of the present evaluation.

9. "Consideraciones y Commentarios de la Derección del Centro. CIENES: Santiago, 1978" provides guidance on the extension of the CIENES program to other countries of the Americas.

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